Cerealier

No. 01/2022

A magazine from
Lantmännen
Research Foundation

OUTLOOK
Traditional grains in Africa

PRODUCT DEVELOPMENT
New processing line for oats

RESEARCH
Dietary fibre affected by processing

THEME
WHOLEGRAINS AROUND THE WORLD

Helena Fredriksson
Future food

Although it may not be the same as really travelling, we hope this issue will provide similar inspiration through our visits to wholegrain researchers around the globe. We note that wholegrain consumption is increasing in the US, with one reason being the interest in plant-based diets, in which wholegrains are an important source of protein. In Singapore, researchers are using labelling and apps to encourage consumers to choose wholegrains.

ALASTAIR ROSS, a researcher from New Zealand, looks at the link between wholegrain products' particle size and their health effects, while efforts are being made in parts of Africa to raise interest in wholegrains through the use of indigenous grains.

Oats remain a hot topic. Our colleague Alf Ceplitis tells us about the first steps in the development of a new oat variety, Active. We also pay a visit to the new oat processing line at Lund University.

"This is the first issue of Cerealier in English..."

ONE ITEM OF NEWS is that this is the first issue of Cerealier in English – please help us spread the word.

The results of Lantmännen Research Foundation's latest call for applications are in, with some of the exciting projects contributing to the development of future foods are described on page 23. And, to round off, we have a great wholegrain recipe to celebrate Easter.

Wishing you a pleasant read!

Helena Fredriksson
Lantmännen Research Foundation

PHOTO: CQYOUNG / ISTOCK

Wholegrains around the world

This issue takes an in-depth global look at consumption patterns and wholegrain research.

Pages 7–15

Cerealier

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(See also image on page 7.)

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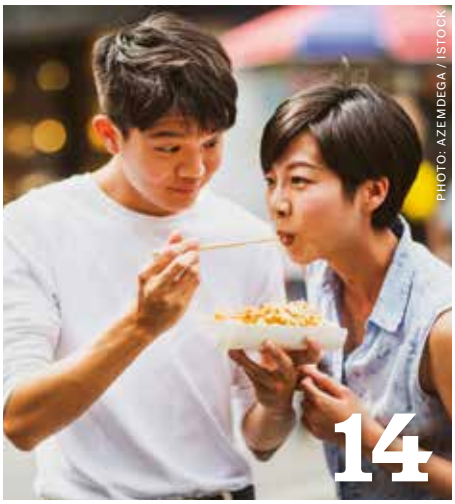

Cerealier Regulars

Theme: Wholegrains

In this issue

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Cerealier is published by Lantmännen on behalf of Lantmännen Research Foundation. Its aim is to increase awareness about cereals (grains) and legumes, based on current research and debates on nutrition.

LANTMÄNNEN
RESEARCH FOUNDATION

ILLUSTRATION: LENE DUE JENSEN

Reviewing the risks associated with a plant-based diet

In a new project, Ann-Sofie Sandberg, professor at Chalmers University of Technology, will examine how increasing our intake of plant-based food affects nutrient absorption.

She will study pregnant women with either a low or high intake of plant-based food, and the effect on the foetus' growth, the nutritional value of breast milk and the baby's nutritional status.

Another part of the project will compare young women's iron absorption from three different meals: one with meat, one with fish and one with broad beans. ●

www.extrakt.se (in Swedish)

5

Oat projects funded by Lantmännen Research Foundation 2021. ●

PHOTO: LANTMÄNNEN / HANS JONSSON

New thesis on legumes

Ferawati Ferawati, PhD student at Linnaeus University, has investigated the nutritional content of Swedish-grown yellow and grey peas, faba beans and white beans, as well as how this changes after boiling, sprouting and roasting.

PROTEIN ISOLATES from locally grown legumes were extracted on a pilot scale and used to produce meat substitutes. The use of legume flours in the development of plant-based cheese was also investigated.

The results show that locally grown legumes have great potential for use in the development of plant-based foodstuffs.

Read more: www.lnu.se/forskning/

Lingonberries may improve gut flora

Jiyun Liu also received his PhD from Linnaeus University. In his thesis, he developed an analysis method for identifying bioactive substances in berries and legumes. In total, 45 bioactive substances were identified, and the health effects of some were studied in mice.

The mice were fed a mixture that included whole lingonberries, brown beans, and dietary fibre, as well as polyphenols from lingonberries and brown beans. The food's impacts on atherosclerosis and the gut flora of the mice were investigated.

The results show that the berries and legumes are good sources of polyphenols, and a diet that included whole lingonberries, brown beans and bean fibres resulted in less atherosclerosis among mice and had a positive effect on their gut flora. ●

Read more: www.lnu.se/forskning/

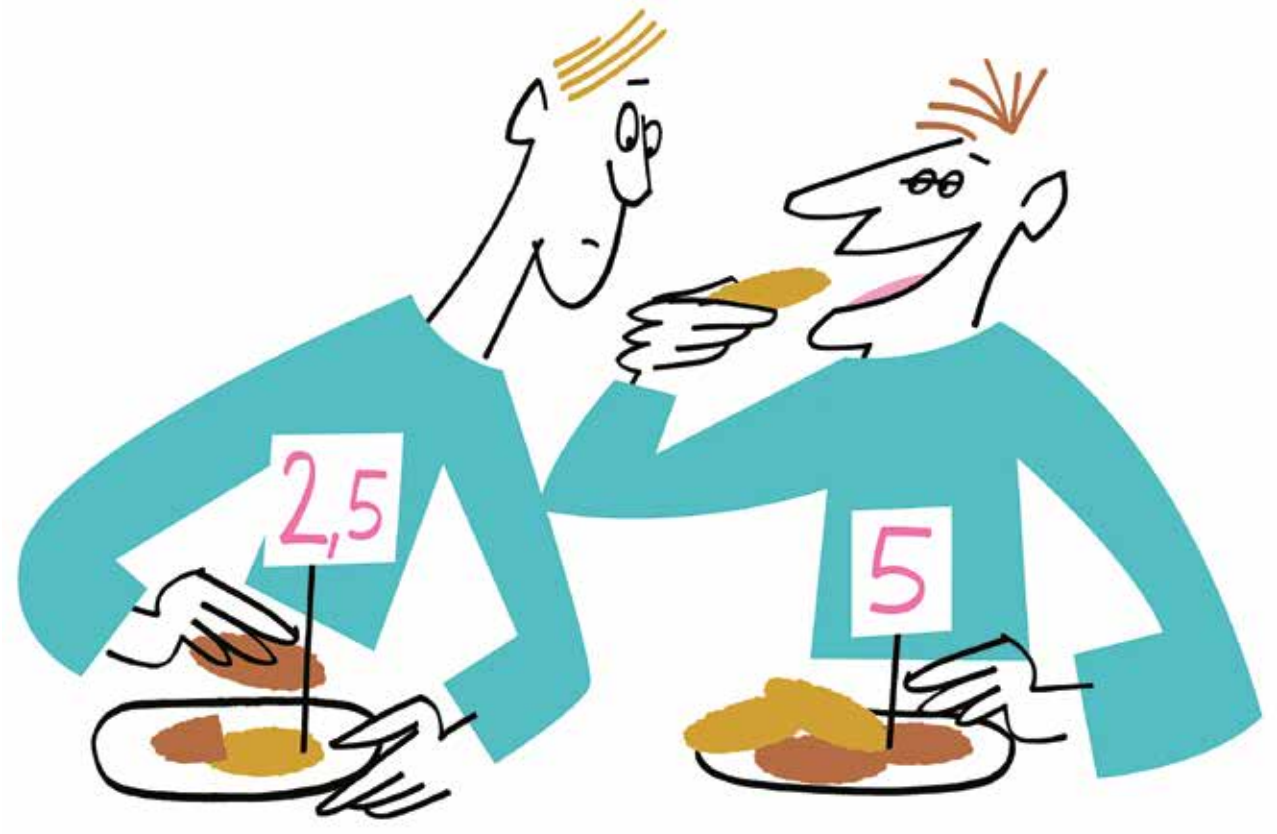


ILLUSTRATION: LENE DUE JENSEN

Blood sugar response may depend on a specific gene

A new study initiated by researchers at Lund University supports the theory that our genes affect the ability to digest food – and thus the risk of developing type 2 diabetes and obesity.

Saliva contains an enzyme, amylase, which breaks down starch. A recently published article shows that individual differences in genetic make-up affect our ability to digest the starch in food.

The study included 19 healthy subjects who ate either two and half or five pieces of bread on two separate occasions, after fasting. Blood samples were taken before eating, and then several times up to two hours afterwards.

All individuals have two to 17 copies of the AMY1 gene. The subjects selected for the study either had very few or very many copies of the gene.

THE RESULTS SHOWED that the subjects' levels of blood sugar and insulin were very different, which was explained by the number of copies of the AMY1 gene. Those with many copies had higher blood sugar and insulin levels after eating the bread because, according to the researchers, they break down the starch more quickly. However, inter-group differences decreased with the higher bread intake.

THE HOPE IS THAT the results will lead to individualised dietary advice on reducing the risk of type 2 diabetes and obesity. This could also provide a basis for tests that measure the amount of amylase in saliva, helping people who need to maintain even blood sugar levels make the right food choices.

Text **Ebba Arnborg**

RESULTS OF THE STUDY

After eating two and half slices of bread, the group with many copies of the AMY1 gene had an 83% higher blood sugar response and a 73% higher insulin level, compared to the group with few copies of the gene.

After eating five slices of bread, the group with many copies of the AMY1 gene had about a 40% higher blood sugar response and insulin level.

Reference: Farrell *et al., Genes & Nutrition,* 2021

PHOTO: VTT

↑ Nesli Sözer

Developing new fats for plant-based products

So far, researchers have mostly focused on proteins when developing plant-based products, but fat is at least as important for obtaining the right consistency, juiciness and flavour, says Nesli Sözer, professor at Finland's VTT.

Her research team has identified the molecular structure and properties that fat must possess for use in plant-based meat substitutes, for example. They then used side streams from the food industry and used yeasts to transform them into new types of fats.

One goal is to replace palm oil in plant-based foods. ●

Read more: www.vttresearch.com

55%

of respondents in Brödinstitutet's latest survey, Brödbarometern – the 'bread barometer', would choose to eat more wholegrains and fibre for better health. ●

ILLUSTRATION: LENE DUE JENSEN

Research funding for food and health

Hjärt-Lungfonden, the Swedish heart and lung foundation, is awarding SEK 333 million to research, with SEK 14 million is for researchers in Uppsala. One of the researchers is Susanna Larsson, senior lecturer at Uppsala University, who will study influenceable risk factors for cardiovascular disease, such as physical inactivity, poor diet and stress.

Ulf Risérus, professor at Uppsala University, will receive funding to study whether a healthy Nordic diet can slow atherosclerosis in people who have had heart attacks. ●

Read more (in Swedish): https://news.cision.com/se

Oat hulls can be used in food

In a new thesis from Lund University, PhD student Eva Schmitz has studied oat hulls as a potential source of dietary fibre. Oat hulls are rich in the dietary fibres lignocellulose and the hemicellulose arabinoxylan.

Eva Schmitz bleached the hulls to obtain a white dietary fibre product and developed a method to increase the solubility of the arabinoxylan fraction, creating shorter chain lengths. This fibre fraction is believed to have a positive effect on gut flora. Overall, oat hulls proved to be an interesting source for producing soluble and insoluble dietary fibres, with the potential for use on an industrial scale. ●

Read more: https://lup.lub.lu.se

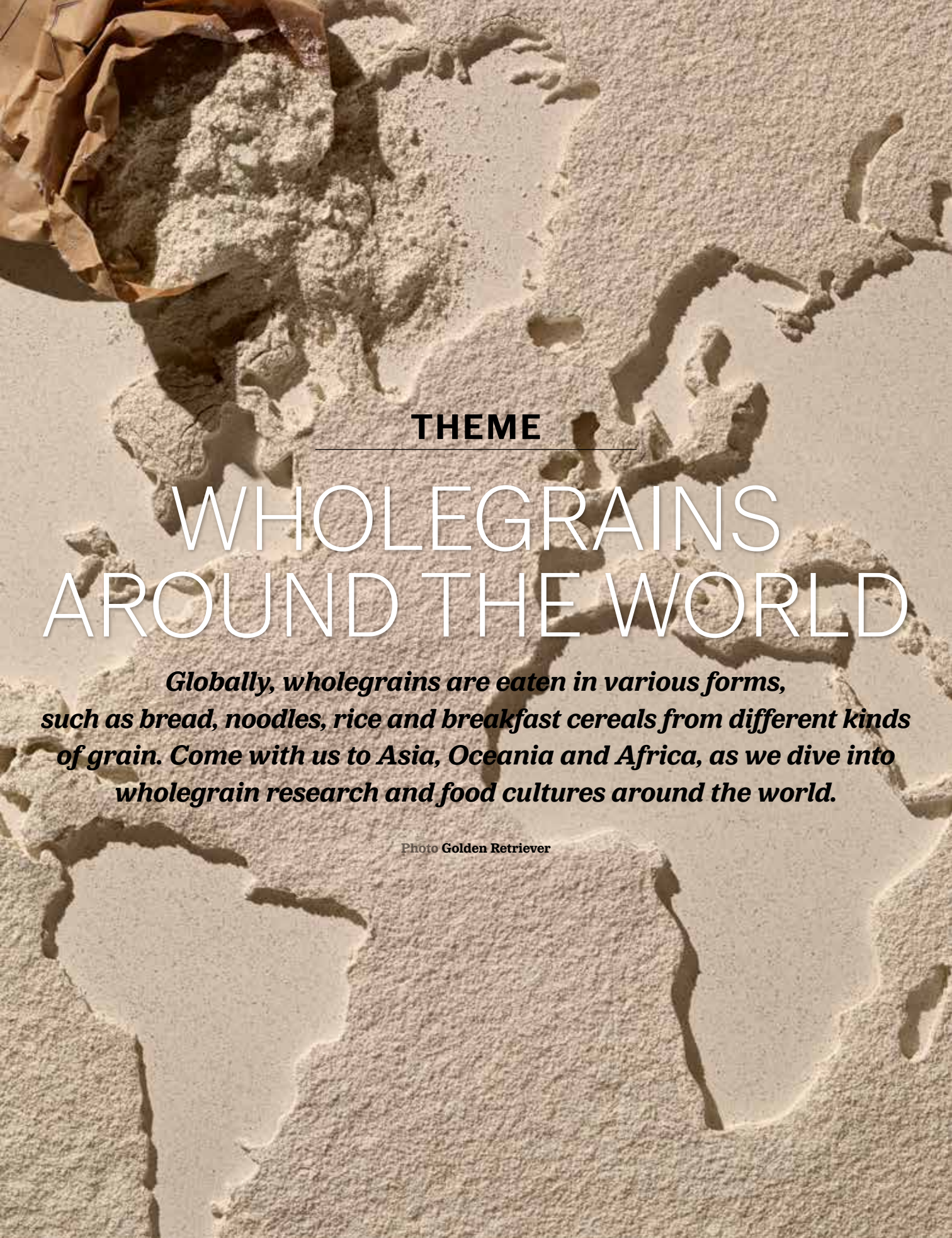
Call for sensory science

PHOTO: SANNA LINDBERG / LANTMÄNNEN

A governmental research council, Formas, now has an open call for research in the field of sensory science.

The purpose is to promote research that will increase knowledge in the field of sensory science among actors in the Swedish food system. The call encourages collaborations between academia and other societal actors. The call closes in mid-May. ●

Read more: www.formas.se

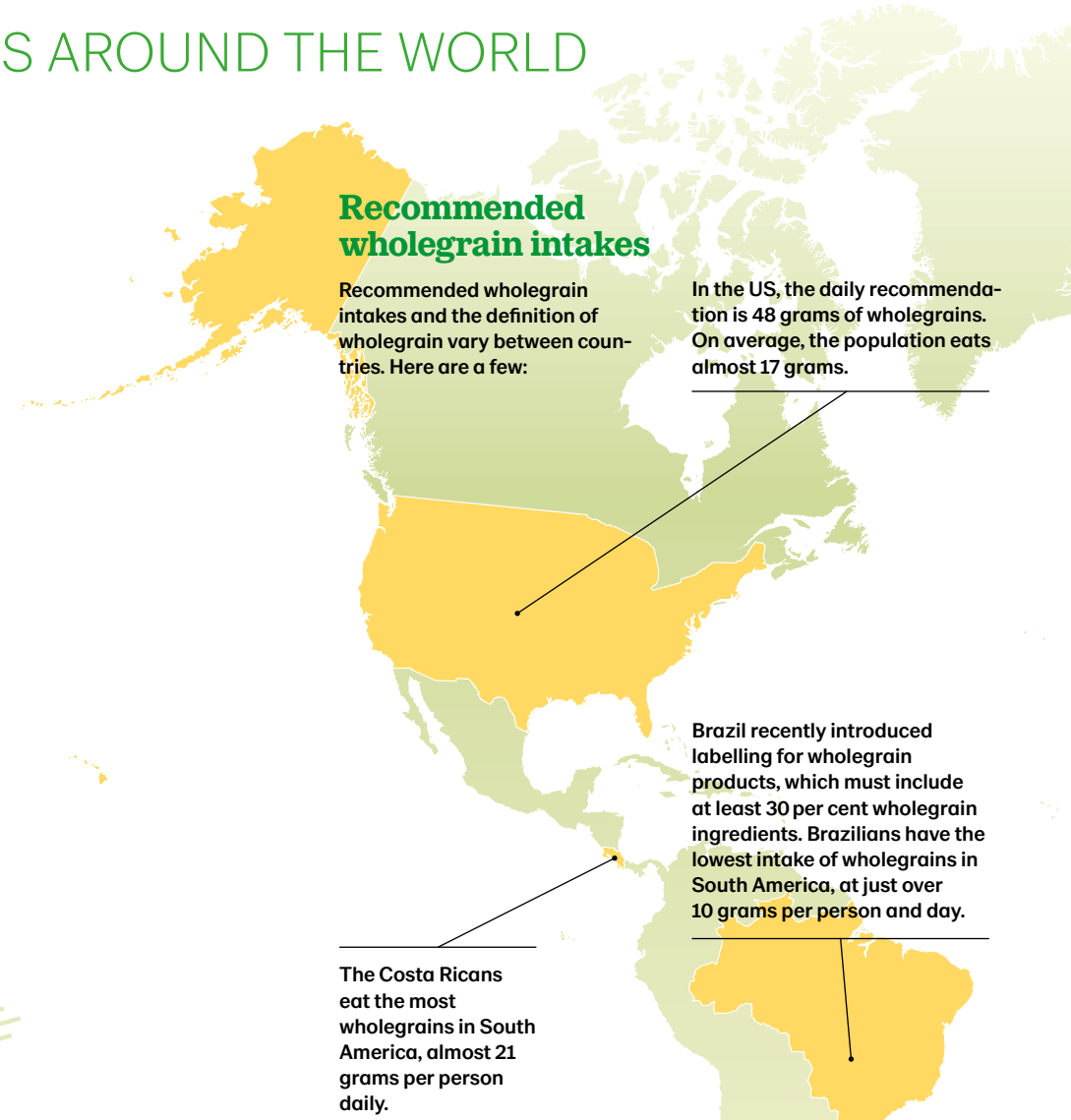


THEME

WHOLEGRAINS AROUND THE WORLD

Globally, wholegrains are eaten in various forms, such as bread, noodles, rice and breakfast cereals from different kinds of grain. Come with us to Asia, Oceania and Africa, as we dive into wholegrain research and food cultures around the world.

Photo **Golden Retriever**



Global increase in wholegrain

Wholegrain intake has increased in the US over the last 17 years. Caroline Sluyter from the Whole Grains Council sees this as an international trend.

"There is a new focus on where food comes from, how it is grown and its impact on health and the environment. Wholegrains have a natural role to play."

Text **Karin Janson**

Caroline Sluyter believes that wholegrain consumption is rising globally, not just in the US, partly due to wholegrains' sustainability and their role as an important source of protein.

"Many people are choosing to eat more plant-based foods and replacing one or two meat-based meals each week. Here in the US, decision-makers have highlighted how wholegrains are good for public health and celebrity chefs are inspiring us to eat more wholegrains."

It is also likely that the Whole Grains Council, and their labelling, helped increase consumption. The organisation was founded in 2003; the label was introduced in 2005. Since then, Americans' daily intake of wholegrains has risen from below 14 g to just under 17 g.

"New national dietary guidelines were launched in 2005, stating that half of the grain products we eat every day should

SOURCES: DANISH WHOLE GRAIN PARTNERSHIP, GRAINS & LEGUMES NUTRITION COUNCIL, SWEDISH FOOD AGENCY, FINNISH FOOD AUTHORITY, EUROPEAN COMMISSION, DEUTSCHES BROTINSTITUT, BRAZIL NATIONAL HEALTH SURVEILLANCE AGENCY

consumption

be wholegrain. The Whole Grains Council has set a recommended daily intake of 48 grams, but the average is now less than 17 grams, so although the level is rising it is still low," says Sluyter.

THE COUNCIL COOPERATES with healthcare providers, food producers, universities and other interest organisations to lobby for wholegrains. Americans eat their wholegrains mainly as bread, followed by breakfast cereals, pasta, oatmeal and rice. Regular surveys show that more and more people are starting to like the taste of wholegrains.

"At the same time, taste is a barrier for people who don't eat wholegrains at all. Our tastebuds change with time and we can learn to like new flavours, but if you don't ever eat wholegrains it will be more difficult to start. We try to influence people using a range of channels, so that more of them make small dietary changes to start with." ●

"Regular surveys show that more and more people are starting to like the taste of wholegrains."

Caroline Sluyter
Whole Grains Council

A growing young population with an urban lifestyle has made sub-Saharan Africa a major importer of wheat for bread and pasta. Reversing this trend and getting more people to eat wholegrains, preferably from African crops, presents many challenges. Researchers recently published an article that highlights this issue. Text **Linda Swartz**

Aims to increase the amount of indigenous grains

John Taylor and Riëtte de Kock are professors at the Department of Consumer and Food Science at the University of Pretoria, South Africa. They describe several reasons for the increased demand for wheat in sub-Saharan Africa: population growth, urbanisation and rising incomes mean that more people want quick, easy food in the form of bread and pasta.

"Bread is central to modern civilisation. It is practical, versatile and can be eaten on every occasion, as a meal or on the go. It's available in every price class. All this makes bread attractive," says de Kock.

AT THE SAME TIME, interest in, and demand for, domestic grains and legumes is falling. These are often more difficult to cook and may be regarded as poor people's food.

"Traditional grains are threshed on the ground in many places in Africa. Sand can get in the mix and the resulting flour can be coarse and unappetising, which is one reason why wholegrains are seen as unappealing," says John Taylor.

He says that the decreasing amount of wholegrain in the daily diet and rising consumption of refined flour contribute to three nutritional problems: lack of protein and fibre, lack of vitamins and minerals, and increasing overweight and type 2 diabetes.

HOWEVER, HEALTH IS NOT all that is threatened by this dietary change, food supplies are too. Cultivating wheat is difficult at these latitudes. Indigenous crops are better adapted and will cope better with future climate change. Riëtte

↗ Durra is a grain commonly used in foods in many African nations. This is a durra field in southern Ethiopia, in the Horn of Africa.

PHOTO: GODDARD / ISTOCK

de Kock and John Taylor say that agriculture is a decisive element in the shift to healthier, more climate-smart food. Quite simply, farmers need to see the benefits of growing durra, millet, teff and other indigenous crops.

"A lot more research is being conducted into the major crops of wheat and maize, leading to an increasing gap between their yields and that of traditional crops. Targeted investment is needed: more money for research and development," says Taylor.

De Kock agrees, adding, "We have seen increased interest in African grains in the rest of the world. Hopefully this will drive agronomic development."

THE GROUP ALSO INCLUDES three other Pretorian researchers and three from Wageningen University in the Netherlands. Together, they have analysed the entire system surrounding bread's value chain in sub-Saharan Africa.

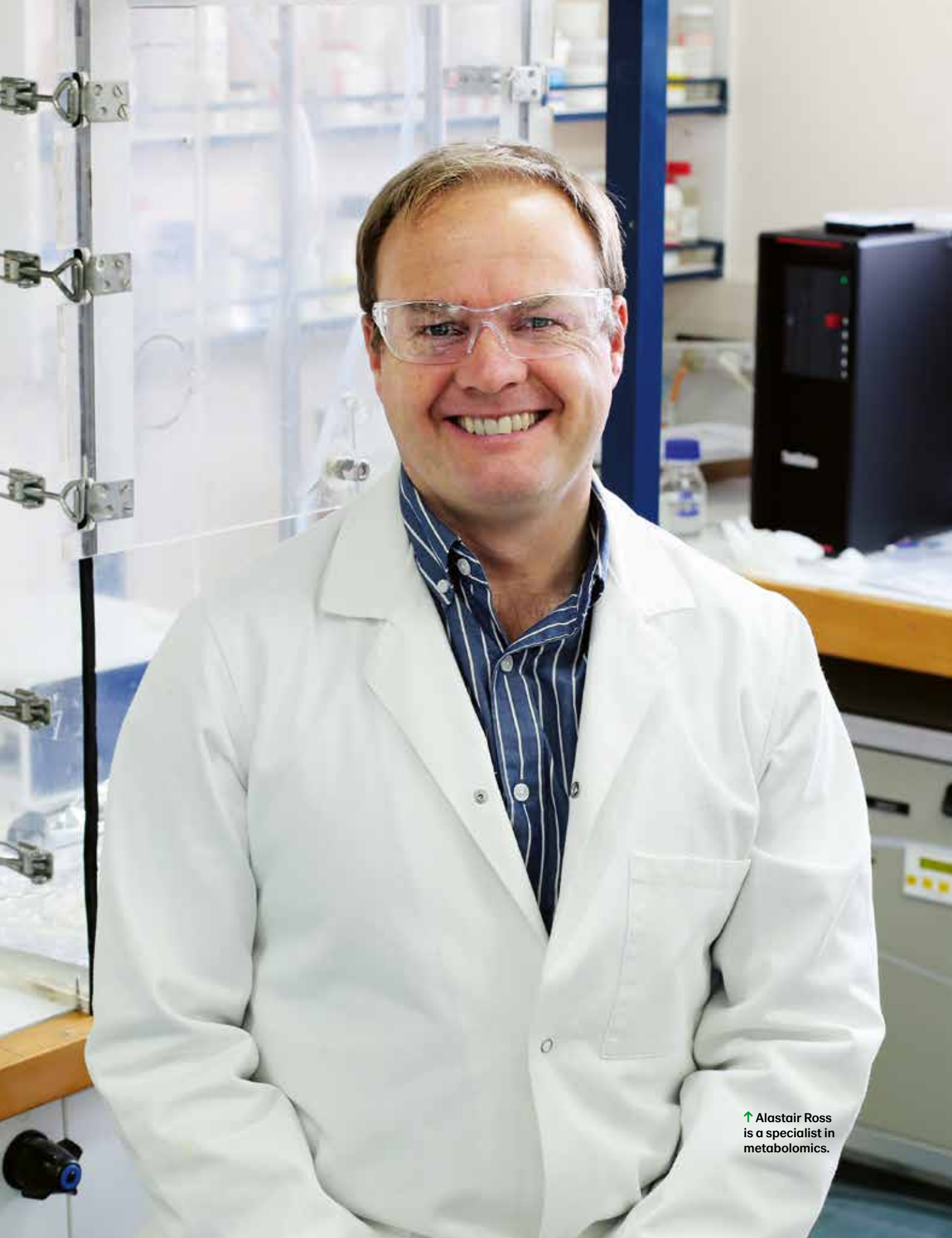
↑ John Taylor

↑ Riëtte de Kock

Based on their analysis, they propose changes in everything from legislation to product development. Not least, there is a need for consumer information about the positive effects of eating wholegrains and preserving knowledge about traditional plants.

Young people have to learn to enjoy the taste. A major project is underway in Rwanda, funded by the Rockefeller Foundation. Over 15,000 schoolchildren have heard about the benefits of wholegrains, and they also eat more indigenous crops than before. John Taylor hopes this initiative will spread to more schools and countries. ●

Reference: Noort *et al., Foods,* 2022



↑ Alastair Ross is a specialist in metabolomics.

Wholegrain particle size may affect blood sugar response

Dr Alastair Ross returned to New Zealand four years ago, after many years of living and working in Sweden.

"Awareness of the health benefits of wholegrains is much lower here," he says.

Text **Karin Janson**

Previously, Alastair Ross researched food chemistry and nutrition at the Swedish University of Agricultural Sciences and at Chalmers University of Technology. He is now in his home country of New Zealand, working at AgResearch, where he specialises in metabolomics – mapping molecules to discover patterns that can prevent disease.

"I became interested in wholegrains during my time in Sweden, and I still try to participate in wholegrain studies when I can."

ALASTAIR ROSS HELPED analyse the results of a recently published study, where the lead researcher was Andrew Reynolds, from the University of Otago, New Zealand. The study examined the particle size of wholegrain products' effect on blood glucose response in people with type 2 diabetes. Wholegrain products using wheat, oats and rice were compared in a randomised crossover study of two-week interventions. The results show that the products with the biggest particle size produced a lower blood glucose response in the subjects.

"We will continue and conduct a longer study, but the first results are interesting for people with type 2 diabetes. For them, dietary recommendations could be revised to not only recommend wholegrains, but wholegrains with a larger particle size, such as bulgur instead of couscous," says Alastair Ross.

There is not much previous research into the health effects of wholegrains' particle size.

"This is very interesting, and may explain why there is such great variation in the results of wholegrain studies. Some studies and have shown large effects and others none at all, which could be explained by the use of foods with different particle sizes."

ALASTAIR ROSS WAS part of developing the global definition of wholegrains, which the Whole Grain Initiative launched last year.

"It wasn't just science, but also a lot of negotiation. Every country has its own food culture. In Germany and the Netherlands, wholegrain bread must contain 100 per cent wholegrain, while Sweden's definition is 50 per cent wholegrain based on dry weight. In France and Italy, the idea of coarse flour is fairly alien to most people, so a small amount of wholegrain is a step in the right direction. No one is right or wrong, but getting everyone to pull together was challenging.

"... wholegrain with a larger particle size. For example, bulgur instead of couscous."

Alastair Ross, AgResearch

GLOBAL DEFINITION OF WHOLEGRAIN

According to the definition from the Whole Grain Initiative, a wholegrain product must contain at least 50 per cent wholegrain based on dry weight, and a product must contain at least 25 per cent wholegrain to have the text "contains wholegrain" on the packaging.

The new definition may be a good way of increasing wholegrain intake, he reasons.

"Taking an academic or public health perspective is easy but, for the industry, consumers must like and want to buy the products. And I think the definition is good, so countries that don't currently demand as much wholegrain in their products can gradually increase intake to the levels in northern Europe, for example."

What is it like in New Zealand?

"There's not at all the same variety of wholegrain products as in Nordic countries. There are some wholegrain breads, but Scandinavians would certainly complain about the range and quality. Instead, there's a focus on food being good value, and dietary advice is largely about eating fruit and vegetables."

MUESLI BARS AND breakfast cereals are the biggest sources of wholegrains, but often contain a lot of sugar.

"Obesity and its side effects are major problems here, and a great deal of the food culture is unhealthy, with fish and chips and other fast foods. We need to eat more whole grains, but awareness is low. The Danish wholegrain initiative is a fantastic example of success at increasing intake, we need something like it here." ●

Reference: Åberg *et al., Diabetes Journal,* 2020

Research programme wants to improve dietary choices in Asian cities

Consumption of wholegrain rice and noodles has increased in Singapore, after a governmen-nt health campaign highlighted the benefits. Meanwhile, lifestyle diseases continue to increase. The Panda research programme is working to reverse this trend by mapping and changing the population's dietary habits.

Text **Karin Janson**

The aim of PANDA (Physical Activity and Nutrition Determinants in Asia) is to investigate dietary habits and activity levels in urban environments. The project owner is the Saw Swee Hock School of Public Health in Singapore, where Professor Rob Van Dam previously worked. He has recently moved to the US, but is still an active researcher with PANDA.

"We want to understand behaviours linked to diet and health, so we can develop better guidelines and preventive measures for obesity and chronic diseases. In Singapore, the government has invested in improving the treatment and prevention of obesity, diabetes and cardiovascular diseases, which are now more common in many Asian countries.

ONE STUDY THAT IS PART of the PANDA programme shows that social norms, social networks and social media are three factors that greatly influence dietary choices.

"Social media has more impact on younger age groups. Social factors are important, because there is a strong tradition of eating together in Asian countries. Traditional ideas about food and social norms can vary between different ethnic groups in the country," says van Dam.

Behavioural change could be facilitated by using dynamic food labelling, something that Professor van Dam and two other researchers have investigated in another study. 125 participants shopped in an online store where all the food products were labelled using the Nutri-Score system (see fact box).

This was combined with real-time information about the overall nutritional quality of their shopping basket. Compared to the control group,

NUTRI-SCORE

Nutri-Score is food labelling that is placed on the front of the package, with information about the product's nutritional quality.
Nutri-Score is based on a 5-step colour scale with the letters A–E, where A is the healthiest option.
Nutri-Score is used in several countries, but not in Sweden. However, products with Nutri-Score may be sold in Sweden if they have been introduced in another country first.

↗ **Eating together is a strong tradition in Singapore.**

PHOTO: ISTOCK

people who encountered Nutri-Score labelling and real-time information had nutritional content that was an average of 13 per cent better. For example, the amount of sugar in their products was almost 1 gram lower per portion than in the control group.

"Social factors are important, because there is a strong tradition of eating together in Asian countries."

Rob Van Dam
Professor Saw Swee Hock School of Public Health

"Online shopping is relatively common in many Asian countries, and these results show there is great potential for improving the quality of people's diets through labelling and real-time feedback," says van Dam.

WHAT IS WHOLEGRAIN INTAKE like in Singapore?

"The Ministry of Health highlights wholegrains as part of a healthy diet. The biggest sources are bread and flakes, such as oat porridge. Singapore's food culture is a mix of many different cultures and many people regularly eat bread. Consumption of wholegrain rice and noodles has increased recently, after the government introduced support for local food companies that develop wholegrain products," says van Dam. ●

Reference: Shin, *et al. Nutrients,* 2020

↗ Martin Hedström and Inger Ahldén by the new pilot line, which has a capacity of up to 350 litres per batch.

Creating new and innovative

A new pilot process at Lund University is providing a basis for new oat products, optimised for health, climate and efficient production. It will primarily be used for research and development.

Text **Ebba Arnborg**
Photo **Christian Andersson**

The ScanOats industrial research centre, funded by the Swedish foundation for Strategic Research, and which has Lantmännen, Oatly and Swedish Oat Fiber as partners, opened four years ago with the aim of developing new knowledge and innovative oat products.

"We're now bringing together everything we have done so far, taking the results forward by building a pilot line where we can make products, and also testing them in various ways – all so we can understand the links between raw ingredients, processing and health effects," says Inger Ahldén, research coordinator for ScanOats.

THE NEW PILOT LINE has an estimated capacity of up to 350 litres of product per batch, and can be used by stakeholders in ScanOats.

Located at Lund University, this line is special because processing can be done using several stages of wet milling, which allows finer milling. This means that more of the oat kernel can be used, which is interesting for its health aspects, as well as taste and texture, says Martin Hedström, the researcher leading the project at Lund University.

"Our main focus, apart from understanding the links between the raw material and the process, is studying the health aspects of oats. It is a unique crop, as it contains beneficial fats, high levels of protein and good dietary fibre. We also want to develop products that

oat products

are tasty and which people like," he says. "ScanOats is developing new oat varieties, with different compositions of protein, fat and carbohydrates. The pilot line allows the development of products with specific properties that can be further investigated in the next step."

ANOTHER INTERESTING AREA of study that uses the pilot line is enzymation, where enzymes are added to the oats to change the properties of the final product. The purpose is to find innovative ways of using oats as an ingredient in new oat products. Hopefully, the research and upcoming trials will lead to new knowledge, which can then be applied on an industrial scale. Oat base is already used in oat drinks, for example, but it could now be utilised in entirely new products.

"Oats contain beneficial fats, high levels of protein and good dietary fibre."

Martin Hedström
Researcher at Lund University

"The products we will invest in are decided in cooperation with ScanOat's partners. These could be food products with health-promoting qualities or ingredients. We are at an exciting phase of development," says Inger Ahldén.

The aim is also to see how production processes can be optimised to use as much as possible of the raw ingredient.

"Oats are a sustainable raw ingredient with many valuable substances that need to be utilised. We want to see how we can optimise the entire process, thinking about the climate, environment, health and production efficiency," she says.

This year in Cerealier we will be covering a new oat variety, Active. What is unique about Active? Well, it has higher levels of protein and beta-glucan than other oat varieties. We begin with the plant breeding work for Active. Text **Karin Janson**

Active – a new oat variety with a higher protein content

Alf Ceplitis is a group manager at Lantmännen's plant breeding unit in Svalöv and CEO of CropTailor AB, a company in which Lantmännen is the majority shareholder and which develops new properties in oats. Usually, many different qualities are desirable when a new variety is developed, such as disease resistance, quality, yield and heat and drought hardiness.

"However, with Active we focused on two things: protein content and levels of beta-glucan, which is a fibre that has a documented positive effect on health. We said we'd try and see how far we get."

ACTIVE IS ALSO the first oat variety in the world to be produced using genomic selection, a new method that is having a real impact on plant breeding.

"There are genetic markers in the genome that affect different characteristics. We can read the genome like a bar code and then we use statistical modelling to see whether a plant will have good yield, good resistance or other properties we want," says Alf Ceplitis.

IN BREEDING PROCESSES, genomic selection has been combined with speed breeding, where plants are cultivated in a controlled setting in growth chambers. This allows several growing seasons per year, providing more rapid development from crossing to variety.

"Plant breeding is currently undergoing a technological transformation, where Lantmännen is leading the field. We were the first to use genomic selection in oats and now we're underway with other crops as well," says Ceplitis.

"Plant breeding is undergoing a technological transformation."

Alf Ceplitis Group manager, Lantmännen's plant breeding unit in Svalöv

Meanwhile, field trials have been conducted for seven years, testing Active in different weathers and sites. Levels of beta-glucans and protein have varied between harvests, with average protein levels at 20 per cent.

"Sweden's most common oat variety, Galant, has about 13–14 per cent protein in a dehulled kernel. Common oat varieties are about 3.8 per cent beta-glucans, Active has an average of 6.5 per cent," says Ceplitis.

Yields are somewhat lower than for other varieties, but field trials in Finland have had higher yields than in Sweden.

"Active is not grown for its yield, but for the high nutritional content. This is a special variety with a bright future."

WHEN AND HOW Active will be launched on the market is still unclear. First, it must be cultivated on a large scale on test farms. There is already great interest in the variety.

"We know there is huge demand and the interest from a range of actors is positive," says Ceplitis. ●

PHOTO: HANS JONSSON / LANTMÄNNEN

↑ “There is great demand for Active,” says Alf Ceplitis.

In a new review article, eleven European researchers summarise what we now know about how processing affects dietary fibres from grains. Text **Karin Janson**

Processing affects dietary fibres in grains

Grains, particularly their bran, have a high dietary fibre content, with wheat, rye, barley and oats containing 10 to 25 per cent. Arabinoxylan is the dominant dietary fibre in wheat and rye, while there is a large proportion of beta-glucans in oats and barley. Rye has the highest proportion of fructans and oats the lowest. Other dietary fibres are cellulose, lignan and resistant starch.

THE ARTICLE CITES studies that investigated how dietary fibres change due to common processing methods such as milling, fractioning, baking, fermentation, freezing doughs, sprouting and extrusion. The impact of processing on dietary fibre is important for understanding and optimising qualities such as texture and taste, while also getting the desired health effects. The most common changes lead to cell walls being broken down and particle size reduced, followed by depolymerisation. This is when the dietary fibres are split into smaller units, and it increases the fibres' solubility and fermentability, and reduces viscosity. This, in turn, is important for the glucose response and satiety after product intake.

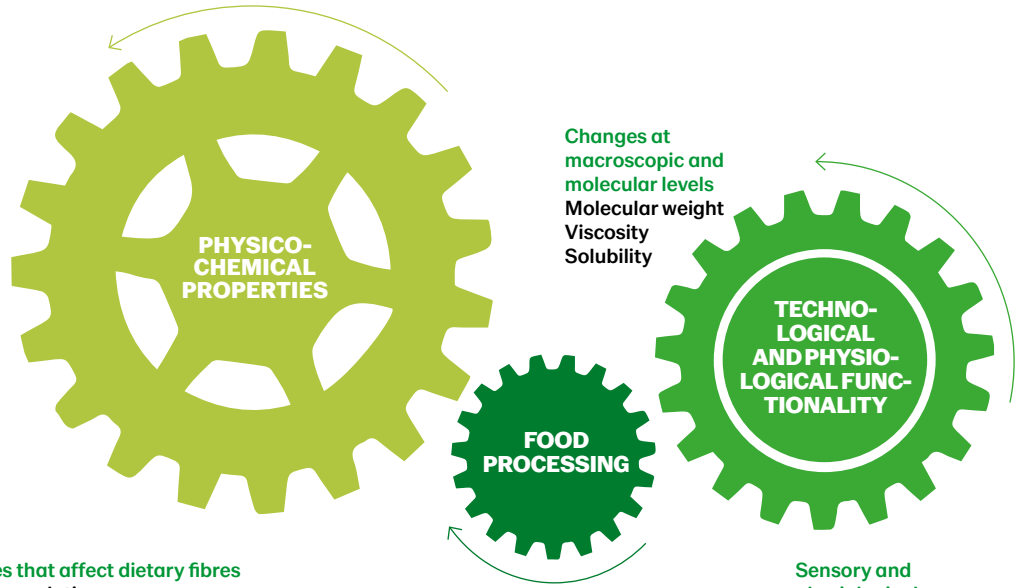
MORE EXTENSIVE FRAGMENTATION, hydrolysis, which occurs during baking, can also remove oligosaccharides and affect the dietary fibres' fermentability in the large intestine. Aggregation may also occur, which can lead to an increased amount of insoluble dietary fibres and the formation of resistant starch.

The authors emphasise that some form of processing is always necessary, because grains cannot be consumed raw. Knowledge about the effect of processing methods on the dietary fibre complex is important, as there is potential for affecting properties in negative or positive ways. We therefore need to learn more about the effects of processing on grain fibres, such as methods for characterising and quantifying dietary fibres' properties, work that should be done in cooperation between research disciplines like chemistry, food science and nutrition. ●

Reference: Maina *et al., Foods*, 2021

Processing that affects dietary fibres

Examples of changes to the properties of dietary fibres due to processing. These may be intentional or unintentional, and can change the fibres' properties and function for better or worse.



Processing methods
Milling
Fractionation
Baking
Extrusion
Steaming
High pressure treatment
Fermentation

Process stages that affect dietary fibres
Mechanical degradation
Thermal degradation
Microbial activity
Enzyme activity (added/endogenous enzymes)
Acid hydrolysis
Oxidation

Changes at macroscopic and molecular levels
Molecular weight
Viscosity
Solubility

Sensory and physiological properties
Texture and structure
Flavour release
Digestibility
Glycaemic response

↑ Lamb is a perfect Easter dish, served here with light sides and plenty of greens. Recipe from www.sundkurs.se

PHOTO: ULRIKA EKBLOM

RECIPE

A colourful Easter dinner

Roast lamb with a wholegrain bulgur salad

Serves: 6
Time: 1 hour

1 kg boned lamb steak
2 tbsp dried rosemary
2 garlic cloves, grated
1 tsp salt + 1 tsp freshly ground black pepper
1 tbsp rapeseed oil

Bulgur salad
200 ml wholegrain bulgur
1 red pepper, deseeded and chopped
1 yellow pepper, deseeded and chopped
1 red onion, peeled and chopped
1 large bunch chopped flatleaf parsley
Juice of ½ lemon
Rapeseed oil

Yoghurt dressing
200 ml low fat (3%) Turkish yoghurt
1 tsp hot sauce, e.g. harissa, Tabasco or sriracha

To serve
Green salad, preferably with French beans

INSTRUCTIONS

1. Heat oven to 175°C.
2. Rub the lamb steak with the rosemary, garlic, salt, pepper and rapeseed oil.
3. Brown the meat in a little oil in a frying pan, to give it a good colour.
4. Place the meat in an ovenproof dish and cook in the middle of the oven until it has an inner temperature of 68–70°C. Leave to cool, then slice thinly.
5. Cook the wholegrain bulgur, following the instructions on the packet, while the lamb is roasting.
6. Fry the peppers and onion in a little rapeseed oil and combine with the bulgur and parsley. Squeeze in the lemon juice and stir in a little rapeseed oil.
7. Mix the yoghurt dressing and serve. ●

Sales of chilled and frozen vegetarian foods have increased in Sweden for the fifth year running. Plant-based products are here to stay, but there are indications that the more forgiving stage of the love affair is over, with consumers placing higher demands, write Anders Engström, who works with business intelligence at AGFO.

The second veggie wave is here

Trade is seeing a shift, with plant-based foods no longer only attracting people who identify as vegetarians or vegans, but also flexitarians and reducetarians – people who have not removed meat from their diets but who eat more vegetarian food. In some ways, we are returning to a time when Swedes did not eat meat every day, and you were either rich or a little mad if you ate meat every day of the week.

Recently, "ultra-processed" foods have been hotly debated in Sweden, and many people are starting to question whether consuming products with lots of processed components is healthy. Right now, researchers say "it depends", but we will certainly be seeing more veggie options with shorter ingredient lists.

ONE INTERESTING ITEM at AGFO's latest trend-watch seminar was that we'll be seeing more veggie alternatives that taste of... vegetables! A veggie burger that tastes of meat has its place, but many people want veggie burgers that taste of what they're made from.

However, at the same time, we will be seeing veggie-meat that resembles meat more than ever, both appearance-wise (as 3D-printed cuts of meat have already been displayed in London) and flavour-wise (with companies working on producing the perfect fat). It could even be the case that we see cultivated animal fat combined with vegetables, a hybrid meat. Could this be many reducetarians' sensory dream?

MEAT CONSUMPTION IS increasing in much of the world, particularly in countries with a booming middle class. However, in countries that have long been wealthy, we are seeing a clear downward trend in the high levels of meat consumption. In Sweden, we have an interesting curve, with meat consumption increasing steadily until 2017, when it began to fall. I believe this trend will continue and that meat will eventually become, once again, something that is a treat rather than everyday food.

Myself, I hope the next big trend will be "upcycling". Utilising food that is never harvested, that is rejected, or which vanishes during processing. Perhaps a burger made from fermented spent grain from breweries? Or the potato protein that is left over when the starch industry has done its job?

The veggie revolution has just begun.

Anders Engström

"...we'll be seeing more veggie alternatives that taste of... vegetables!"

PHOTO: JESPER MOTT

Anders Engström
Business intelligence analyst at AGFO, a business network for the Swedish food system

Want to feature in "From my perspective"? Email us at: tidskriftenc@lantmannen.com Cerealier is not liable for submitted materials.

PHOTO: LANTMÄNNEN

↑ Lantmännen Research Foundation granted funding to 15 projects in 2021.

Future food – proteins, oats and bread quality among our new projects

How to stop oats going rancid, the future of green foods and improving the quality of frozen bread. These issues will be investigated by some of the research projects granted funding in the autumn of 2021. Helena Fredriksson from Lantmännen Research Foundation has high hopes for the projects.

Helena Fredriksson Head of Research at Lantmännen Research Foundation

Contributing to creating the future of agriculture, food and bioenergy is a lofty ambition. Lantmännen Research Foundation is now busy establishing 15 new research projects that were selected from the 50 applications submitted to the open call in the autumn. Areas specified in the call were improved bread quality, the fractioning of grains and legumes, and their health effects.

An exciting project at the University of Helsinki deals with improving the quality of frozen bread. It is a high-risk project but, if it goes well, it could be very successful.

OATS ARE ALWAYS in focus, not least because of their protein quality and fibres that can reduce blood cholesterol. Several projects about oats received funding.

One project at the University of Copenhagen is about using new technology to bake bread from oats, one at Lund University is about stopping oats becoming rancid during processing, and another one at the Swedish University of Agricultural Sciences (SLU) is about how different oat varieties and cultivation strategies affect the risk of acrylamide formation during heating.

Consumers are very interested in oats, so there is great potential for new products. We are optimistic about the future of the new oat variety, Active, covered on pages 18–19.

There are trends in research; proteins are currently a hot topic, looking at the entire chain from cultivation to final product. For example, a new project at the University of Copenhagen will look at the development of the next generation of green food based on Nordic ingredients. In cooperation with SLU, protein is studied early in the chain, focusing on developing a domestic feed for laying hens, the hypothesis being that protein quality and insoluble fibre can help reduce the problem of ammonia production in animal housing.

RESEARCH REALLY IS an amazing opportunity to take a deeper look, generating knowledge that can contribute to development and success from field to fork. The hope is that the results of these projects will be put into practice in the future. ●

PHOTO: MIZRAK / ISTOCK

Our first issue in English

From this issue, Cerealier will be published in Swedish and English. The English version is only available online. If you want to subscribe, please visit: *www.lantmannen.com/cerealier*

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About the research foundation

Lantmännen Research Foundation supports research in the entire chain, from field to fork. It grants up to SEK 25 million to research annually, focusing on three areas:

• Agriculture and machinery
• Bioenergy and green materials
• Food and packaging

The goals of this research funding include increased agricultural production with minimised environmental impact and establishing how agriculture can contribute to the development of a biobased society. In the area of food, we want to increase knowledge of grains and legumes as a natural element of sustainable future food.

The foundation holds an open call every autumn, starting in September. See *www.lantmannen.com/researchfoundation*

Applications are assessed on their newsworthiness, scientific quality and business potential. Decisions are announced in December. ●

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LANTMÄNNEN RESEARCH FOUNDATION